Ministry of Natural Resources

Ontario Lyn McLeod Minister

Northwestern Ontario Forest Technology Development Unit

# 1989/1990 ANNUAL REPORT

## EXECUTIVE SUMMARY


The fiscal year 1989/90 was a very active program period for the Northwestern Ontario Forest Technology Development Unit (NWOFTDU) in the major program areas of technology management, technology transfer and development/demonstration projects. Two major initiatives that were undertaken were the beginning of the field workshop series and a provincial program evaluation/review of the NWOFTDU.

Under the NWOFTDU's technology management program, two literature reviews, six technical reports and three technical notes were completed and published. The old forestry trial inventory was near completion (1,680 entries) and the computerization of the joint Northern Forest Biology Centre/NWOFTDU library was approximately half finished.

The NWOFTDU's technology transfer program included publishing two issues of the newsletter "On-Line" and a symposium on "Tools for Site Specific Silviculture in Northwestern Ontario." During 1989/90, the NWOFTDU sponsored a number of specialized courses/workshops including "Design and Analysis of Experiments" and Forest Ecosystem Classification Training. Staff specialists at the NWOFTDU spent considerable time on extension calls, assisting field managers in solving field problems, or providing requested information.

A series of field workshops were held throughout northwestern Ontario during the summer and fall of 1989. The purpose of these interactive workshops was to transfer newly developed technology to northwestern Ontario resource managers in their own field setting. These workshops were one or two days in length; addressed one or two topics suggested by the field managers; were limited in attendance to a maximum of 30 people (15 to 25 preferred); included a practical field exercise; and brought together FMA and OMNR staff (technicians, foresters and biologists) to address common issues and concerns. During 1989/90, fifteen different workshop topics were covered in eight different locations.

Twenty-one new development/demonstration projects were approved and initiated during the 1989/90 field season. These were in addition to nine ongoing projects from 1988/89. Noteworthy NWOFTDU projects include: the Northwestern Ontario Forest Ecosystem Classification; a Crop Planning Process for Northern Ontario; Stock Handling Guidelines for Northwestern Ontario; Lower Cost Regeneration Options; a Competition Index; and a Moose Habitat Primer.

A provincial program evaluation/review of the NWOFTDU was undertaken between February 5 to 8, 1990. A multi-disciplinary/organization review team had no conceptual difficulties with the NWOFTDU and felt it had a good infrastructure for delivery. Notwithstanding these strengths, there were a number of areas for improvement including reviewing the structure and process of the NWOFTDU committee system; refining the project problem identification process; reducing the amount of energy devoted to undertaking development projects; and re-channelling this energy into the technology transfer (field workshop) area.

The NWOFTDU had a budget allocation of approximately $1.2 million from OMNR and MNDM funding during 1989/90. Expenditures from these funds amounted to $1.124 million.

## INTRODUCTION

The annual report for the Northwestern Ontario Forest Technology Development Unit (NWOFTDU) outlines the achievements and expenditures of the unit for fiscal year 1989/90. This annual report highlights program achievements and project status in each of the following areas: technology management, technology transfer, development and demonstration projects and administration. The object of this report is to review and report on the status of those approved NWOFTDU activities outlined in the 1989/90 Work Plan. The NWOFTDU staff have been active in many current forestry and integrated resource management issues. These have included the development of: the Northwestern Ontario Forest Ecosystem Classification; A Crop Planning Process for Northern Ontario; Stock Handling Guidelines for Northwestern Ontario; a Competition Index; and a Moose Habitat Primer.

The fiscal year 1989/90 at the NWOFTDU saw two major initiatives: the NWOFTDU's field workshop series and a provincial program evaluation/audit. Both of the activities were a success and are elaborated upon in this annual report.

## LITERATURE REVIEWS AND TECHNICAL REPORTS

Two literature reviews (Prescribed Burning for Black Spruce Regeneration and Riparian Reserves in Timber Management) were completed during 1989/90. The objective of these literature reviews was to summarize the existing information on these topics in an easy to read format. In addition, an annotated bibliography was completed on growth and yield for northwestern Ontario boreal forest species.

Six technical reports were completed by NWOFTDU staff during 1989/90. Topics which were covered include spruce growth response to aerial release treatment, a crop planning process for northern Ontario, and jack pine site productivity.

A listing of NWOFTDU 1989/90 publications is found at the end of this annual report.

## TECHNICAL NOTES

During 1989/90, three Technical Notes were produced. The purpose of these Technical Notes is to provide a practical summary of critical aspects of operational silviculture and habitat management as they apply to northwestern Ontario. The three subjects covered by Technical Notes were: Snow Cache Seedling Storage (TN-03); Marten and Fisher Response to Cutovers (TN-04); and Cutting Patterns for the Protection of Tourism Values (TN-05).

## OLD FORESTRY TRIAL INVENTORY

The old forestry trial inventory is nearing completion. This project was an inventory of all published and unpublished operational/research trials related to forest management and forestry-wildlife issues (i.e., habitat management) in northwestern Ontario. The trials were conducted by OMNR districts, regions and its research branch, as well as by the forest industry. Copies of all trials and reports (both complete and incomplete) were made and are being housed at the NWOFTDU. Abstracts of these reports have been prepared and the data entered on the library software package Pro-Cite. Approximately 1,680 entries have been completed and data entry is almost complete.

A documentation/instruction package is being prepared. Upon its completion, the old forestry trial Pro-Cite data base will be sent to NWOFTDU clients for their use (summer 1990).

A total of $53.4 M was spent on the old forestry trial inventory during 1989/90.

## LIBRARY

Computerization of the joint Northern Forest Biology Centre (NFBC)/NWOFTDU library continued during 1989/90. Approximately 11,000 entries including abstracts have been completed on Pro-Cite library software. Of these, almost 8,500 entries have been made available to our client group.

The northwestern regional OMNR forest management library was donated to the joint NFBC/NWOFTDU library at the end of March 1990. This valuable collection brings the library's holdings to approximately 22,000 articles. It is anticipated that the entire library should be computerized by the end of fiscal year 1991/92. This depends upon the number of abstracts which must be created.

A library steering committee was established at the end of 1989/90. The purpose of this committee is to ensure that the interests of all parties involved in the joint library are addressed and the objectives of the library are achieved. The library committee consists of a representative from each of the NFBC, NWOFTDU, one OMNR district, an FMA holder, as well as the library technician. The inaugural meeting took place in April 1990.

It was recognized that in order to make this joint library effective, the NWOFTDU needs to market the library to its clients. To this end, a portion of several NWOFTDU field workshops (Manitouwadge, Kenora) was devoted to training on the use of Pro-Cite software.

A total of $33.1 M was spent by the NWOFTDU on the joint library.

## TECHNOLOGY TRANSFER

### Newsletter

Two issues of the newsletter "On-Line" were published during 1989/90. The spring 1989 issue (Vol. 2, No. 2) outlined the 1989/90 NWOFTDU development projects, and featured electronic data collection. The fall issue (Vol. 2, No. 3) highlighted direct seeding of black spruce based upon some of the results of Forestry Canada's research on upland sites near Thunder Bay.

One of the objectives of the newsletter is to disseminate practical and interesting forestry and/or wildlife information to our client group. To accomplish this, the newsletter requires articles, notes or letters describing pertinent techniques, equipment or applications from our clients. Any comments, suggestions or complaints regarding the content of the newsletter are most welcome.

### Workshops

The NWOFTDU's annual symposium was held on April 19-20, 1989 in Thunder Bay and focused on "Tools for Site Specific Silviculture in Northwestern Ontario." More than 160 people attended the workshop. The purpose of the workshop was to address the issue of how to implement silviculture within the framework of silvicultural crop strategies. Papers presented at the workshop included those of Les Reed (U.B.C.), David Brand (P.N.F.I.), Willard Carmean (L.U.), James Barbour (Forintek Canada Corp.), Marna Butler-Fasteland (Cloquet Forestry Center), Mike Znerold (U.S. Forest Service) and Charles Wierman (Boise Cascade).

The proceedings from the workshop have been edited but have not been published to date. The workshop proceedings will be available by early summer 1990.

### Field Workshops

A series of field workshops was held throughout northwestern Ontario in the summer and fall of 1989. The purpose of these interactive workshops was to transfer newly developed technology to northwestern Ontario resource managers in their own field setting. Topics, locations and dates for these workshops were organized between the NWOFTDU and its clients.

The field workshops have the following characteristics:

* enrolment limited to a maximum of 30 people from our client group (attendance has ranged from 10 to 30 people);

* each workshop is one or two days in length and usually addresses one or two topics;

* speakers from the NWOFTDU and the scientific community deliver the program; and

* participants include FMA foresters, OMNR unit technicians and foresters, and wildlife biologists.

Fifteen different workshop topics were covered in eight different locations. The following represent the workshops undertaken during 1988/89:

| TOPICS | DATE | LOCATION |
|---|---|---|
| Basic Vegetation Management, Wildlife versus Forestry Needs (video), and Precut Surveys | June 28 - 30, 1989 | Nipigon |
| Black Spruce Seeding Trials | July 18, 1989 | Thunder Bay |
| Basic Vegetation Management, and Forest Ecosystem Classification (FEC) Interpretations | August 23/24, 1989 | Sioux Lookout |
| Vegetation Management | August 29/30, 1989 | Fort Frances |
| Basic Vegetation Management, Low Cost Regeneration Techniques for Black Spruce, and Use of Pro-Cite Library | Sept. 19/20, 1989 | Manitouwadge |
| Site Productivity, FEC Interpretations, and Vegetation Management | Sept. 26/27, 1989 | Thunder Bay |
| Vegetation Management | October 3, 1989 | Red Lake |
| Lower Cost Regeneration Techniques for Black Spruce, Use of Pro-Cite Library | October 5, 1989 | Kenora |

**Vegetation management field workshop in Fort Frances (August, 1989).**

The workshop evaluations have indicated that the field workshops were well received. They will form an ongoing function in the NWOFTDU's technology transfer program.

Expenditures on field workshops during 1989/90 amounted to $38.6 M. This included the cost of contract staff organizing and participating in the workshops, as well as costs associated with implementing the workshops (rooms, transportation, meals, audio/visual needs, etc.).

**Other Workshops**

During 1989/90, the NWOFTDU sponsored several specialized workshops including "Design and Analysis of Experiments" and Forest Ecosystem Classification (FEC) Training.

A three-day short course on design and analysis of experiments for forestry practitioners was held on August 15 - 17, 1989 in Thunder Bay, and October 24 -26, 1989 in Kenora.

Dr. Ken Brown of the School of Forestry, Lakehead University instructed at these courses. The course was intended to aid foresters in designing efficient experiments for their own use. A comprehensive manual on experimental design for forestry was prepared by Dr. Brown for those participating in the course. A limited number of manuals are available to NWOFTDU clients for their use.

Four FEC training courses were held during the summer and fall of 1989. They were:

| NAME | LOCATION | DATE |
|---|---|---|
| Basic Vegetation | Thunder Bay | June 20 - 22, 1989 |
| Basic Soils | Dryden | June 26 - 29, 1989 |
| Applied FEC | Dryden | July 10 - 14, 1989 |
| Soils and Landforms | Thunder Bay | Sept. 26 - 29, 1989 |

The NWOFTDU will offer these four courses again in 1990/91. Starting in 1991/92, the two regional offices will be co-ordinating the implementation of the FEC, and will also be responsible for training.

**EXTENSION SERVICES**

Staff specialists at the NWOFTDU are available to assist field clients in solving field problems and concerns; or providing information needs. Examples of subjects of extension requests made during 1989/90 included:

- growth and yield information for managed plantations;
- regeneration cruising / free-to-grow surveys;
- time of chemical and mechanical SIP;
- competition index for assessing non-crop vegetation;
- prescribed burning and crop tree growth response;
- growth response measurements (TRIM);
- windthrow hazards;
- precision seeders;
- advanced growth of black spruce;
- Forest Ecosystem Classification treatment units;
- aspen survey;
- caribou biology;
- gravel pit reclamation; and
- crop planning.

## DEVELOPMENT/DEMONSTRATION PROJECTS

Twenty-one new development/demonstration projects were approved and initiated during the 1989/90 field season. In addition, nine projects from 1988/89 were still ongoing. The objectives and general project descriptions were outlined in the 1989/90 Work Plan. Project plans providing detailed information on objectives, rationale, methodologies, experimental design, budget and schedule are on file at the NWOFTDU.

A summary of the status of each project by project number is outlined below:

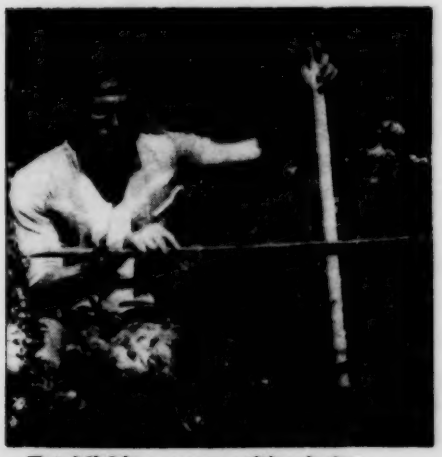
### Project #40, #69 Northwestern Ontario Forest Ecosystem Interpretations

Forest Ecosystem Classification Interpretations for windthrow, prescribed burning and potential for advance growth of black spruce were completed in 1989; and several carry-over interpretations from 1988 were refined: limitations to herbicides, susceptibility to root rot, susceptibility to spruce budworm attack, and pre-harvest surveys. These interpretations will be sent out to the field as updates to the Northwestern Ontario Forest Ecosystem Interpretations after they are printed in 1990.

### Project #41 Development of a 0 to 5 Year Pre- and Post-Spray Competition Index

Currently, no standard approach exists for describing the nature, abundance and importance of competing vegetation within a plantation. The recognition of a competition problem and the need for treatment are often based on visual assessment of height and diameter growth of the crop trees, the relative development of the competitors, or some combination of the two.

A standard approach to assessing and describing competing vegetation, however, is important if one is required to justify and document the need for particular tending or release treatments. Being able to quantify competition levels can also be very useful in assessing the relative success of a particular vegetation management treatment, i.e., comparing pre- and post-vegetation management treatment conditions.



**Establishing a competition index assessment plot.**

The objective of this project was to develop, field-test and market a comprehensive competition index assessment procedure which can be applied in conjunction with other operational regeneration surveys, e.g., survival, stocking or free-to-grow assessments. A competition index combines competitor and crop characteristics to indicate the relative effect of the competing species on the crop or the relative vigour of the crop.

The index is based upon measurements taken from a crop tree centred plot that is 1.13 m radius. Results of all plots in a plantation are averaged for each species and summed to produce an overall competition index value.

Outputs for this project include a literature review of available competition assessment methodologies and an MS-DOS data collection and analysis program configured for use with a DAP data collection terminal. A User's Manual and program documentation are nearing completion. The DAP software was prepared by the Fast Growing Forests Unit in Brockville, Ontario. This project will be concluded in June 1990 with the distribution of the report, User's Manual, program documentation and software.

**Project #42 Integrating Wildlife and Timber Management**

The 42 minute training video "Integrating Wildlife and Timber Management" was released in May 1989. Copies were made available to NWOFTDU clients in northwestern Ontario. An instructor's guide was prepared and circulated to all holders of the video in February 1990.

A public version of the video covering similar subject matter has been produced and will be available through OMNR's Communication's Services Branch by early summer 1990.

**Project #44 Preparation of a Pocket Guide to the Critical Silvics of Conifer Crop Species and Selected Competitive Vegetation in Northwestern Ontario**

The establishment and growth of coniferous plantations is often negatively impacted by other species present on the site that are considered to be "competing" with the crop species. From a silvicultural perspective, competing vegetation includes any trees, shrubs, forbs or grasses that inhibit the survival or growth of crop trees. To pursue forest management goals while recognizing the environmental concerns that restrict herbicide usage, foresters must develop a better understanding of how they can best manipulate the establishment and growth of competing vegetation.

Good vegetation management requires a thorough knowledge of ecological principles and successional trends. As well, the forester should be aware of the growth habits and ecological characteristics of individual competitors including their importance to wildlife management and their response to silvicultural treatment and stand disturbance.

The purpose of this project is to draw together, in the form of an office manual and field guide, practical information on the silvics of selected conifer and competitor species in northwestern Ontario that will aid the forester in developing vegetation management strategies. Five coniferous crop species (black spruce, white spruce, jack pine, red pine and balsam fir) are reviewed in addition to 23 woody and herbaceous species which are potential competitors. The project involved a comprehensive literature review incorporating selected soil/site data from the NWO FEC data base. All reference materials and abstracts relating to the project were placed on Pro-Cite and will be made available to interested parties.

This guide will not provide specific prescriptions for the control of competing vegetation, but will allow forest managers to develop site-specific vegetation management strategies on the basis of ecological and phenological information.

The office manual has been completed and is awaiting publication as part of the Federal Direct Delivery Research Program of COFRDA (Project 33049). It will be available by July 1990. The pocket guide will be available by September 1990.

**Project #46 Shelter Seeding on Highly Productive Sites**

Second-year measurements (1989) were taken on the shelter seeding on a highly productive sites trial. The trial compares the regeneration treatments of shelter seeding, bare seeding and planting current container stock of black spruce and jack pine at three locations (Red Lake, Longlac and Manitouwadge). Tending treatments with Vision on half the replicates are scheduled for 1990.

Results from the second-year measurements indicate that jack pine germinates better than black spruce under shelter cones. For both species, this method of regeneration provides more germinants per spot than bare seeding. In addition, the germination results for shelter seeded trees are higher than bare seeded seedlings. Percent stocking for shelter seeded trees in two locations (Longlac, Manitouwadge) was adequate, whereas stocking for bare seeded trees was a failure.

An interim report will be prepared during 1990, and final (fifth year) measurements are scheduled for the fall of 1992.

**Project #47 Freezer Versus Outdoor Overwinter Storage of Black Spruce Container Stock**

An outplanting trial to compare freezer storage to outdoor overwintering was established during 1988 with black spruce container stock from four private growers in North Central Region, as well as with stock from the Dryden Tree Nursery. Half of the stock was sealed in plastic liners, placed in standard waxed coffin boxes and overwintered in frozen storage during the fall and winter of 1987/88. The other half was overwintered outdoors at the overwintering facilities of the respective private grower or nursery. The stock was outplanted at two sites in Hartington Township of Thunder Bay district. At each site the stock was planted in six replicates in a split plot design with each grower/overwintering treatment represented by 25 tree plots.

Second-year measurements were taken during the fall of 1989. Data analyses are pending with an interim report scheduled for fall 1990.

**Project #49 Aerial Seeding of Jack Pine on Silts and Clays**

Jack pine can be effectively regenerated by aerial seeding in Ontario on coarser textured soils with exposed mineral soil. Finer textured soils on rich upland sites have traditionally been regenerated by planting. Recently, however, demand for planting stock has outstripped supply and forced forest managers to examine other options for regenerating various sites.

In March of 1988, a cooperative project with Boise Cascade, Kenora, was initiated with a view to developing successful silvicultural techniques for aerial seeding of jack pine on fine-textured soils. Three separate trials are included in this project:

TRIAL #1 To document, monitor and evaluate the effectiveness of the spring 1988 operational aerial seeding of jack pine on heavy soils in the Pakwash Forest.

TRIAL #2 To monitor and evaluate the spring 1989 operational aerial seeding of jack pine on heavy soils in comparison to both planting and no regeneration treatments.

TRIAL #3 To compare fall 1988 seeding applied manually at four rates on heavy soils.

Second-year measurements of the 1988 plots were done in August, 1989, and plots were established, but no measurements done, for the 1989 trial. Survival, density and stocking data will be recorded and analyzed for a Technical Report in 1992.

**Project #50 Landsat Satellite Imagery to Evaluate Deer Habitat**

Work on this project is drawing to a close with final analysis and a Ph.D thesis completed. Satellite imagery was not as sensitive to identifying important habitat parameters as originally hoped, but can still be used with a reasonable degree of confidence. A newsletter article and/or Technical Note on using the technique will follow in 1990.

**Project #56 Northwestern Ontario Forest Ecosystem Classification**

After seven years of hard work, the Forest Ecosystem Classification manuals for Northwestern Ontario (NWO FEC) were published during March 1990. The main book, the "Field Guide to the Forest Ecosystem Classification for Northwestern Ontario," along with its two companions, the "Field Guide to Common Forest Plants in Northwestern Ontario" and the "Northwestern Ontario Forest Ecosystem Interpretations," form the basis for a common language to describe our boreal forests.

The manuals are the result of a partnership between a number of agencies, including members of the forest industry in northwestern Ontario, Forestry Canada - Ontario Region, Canada - Ontario Forest Resource Development Agreement (COFRDA), the Ontario Ministry of Northern Development and Mines (MNDM) and NWOFTDU.

Distribution of the manuals got under way in April 1990, based upon the distribution/communications plan. An implementation plan for using the system is being jointly devised by North Central Regional Timber, Northwestern Regional Timber and the NWOFTDU.

**Project #62 Black Spruce Aerial Seeding**

From a number of seeding trials in the Thunder Bay district, Forestry Canada developed prescriptions for successful black spruce seeding on upland sites. The purpose of this trial was to test some of these prescriptions in Northwestern Region as well as to establish a demonstration area for black spruce seeding. In the fall of 1989, three replications of two site preparation treatments were applied to a fine textured, Site Class 2 upland black spruce site. The areas were seeded to black spruce at a rate of 100,000 seeds per hectare in February of 1990. In 1991, a second pass with black spruce at a rate of 100,000 seeds per hectare as well as jack pine at 50,000 seeds per hectare, will be made. Germination and stocking will be assessed in the fall of 1990 and 1991. In addition, a control area will be assessed to determine the ingrowth rate on these types of sites.

**Project #63 Development of a Guide to Site Quality Evaluation in Northwestern Ontario**

Soil/site conditions vary in their capacity to support the growth of the commercially-important boreal tree species. Wood quality is also indirectly influenced by site conditions. Knowledge of these relationships and having a means of predicting anticipated yields will assist the forest manager in organizing and directing timber management activities in accordance with stated objectives.

Since 1979, a number of site quality evaluation studies have been undertaken in northwestern Ontario. This includes work on jack pine, lowland and upland black spruce, trembling aspen, and plantation red pine and white spruce. In addition, a number of studies from other areas in the province and Minnesota have potential applicability to Northwestern Ontario. Finally, the recently completed Forest Ecosystem Classification system for Northwestern Ontario provides additional mensurational information pertaining to the growth and yield of the major tree species stratified by soil/site conditions. The objectives of this project are to:

a) Develop a field guide for the evaluation of site quality in northwestern Ontario; and

b) Communicate to field practitioners an understanding of species - site productivity relationships within the context of the Northwestern Ontario Forest Ecosystem Classification system.

Progress on the project during 1989/90 was limited to collecting and organizing all available site productivity data in preparation for the writing phase. Work for 1990/91 will consist of contracting for the writing and development aspects of the project.

**Project #64 Jack Pine Seed Supply After Full-Tree and Tree Length Logging**

Tree length logging and subsequent scattering of residual crowns and branches has, until recently, been a tried-and-true method of regenerating dry to fresh jack pine sites in northwestern Ontario. Increasing use of full-tree harvesting, with complete removal of bole and crown to roadside, reduces slash loads and, hence, the number of cones left on-site to form the next crop. But what is the magnitude of this reduction?

Twenty-four cutovers were surveyed during 1989 in northwestern Ontario to quantify cone density per hectare as affected by harvest method (full-tree versus tree length), harvest season (spring, summer, and fall, versus winter), and stand age at time of harvest. Preliminary results show that full-tree harvesting reduces residual cone densities to about half of that found on tree length harvested sites (25,000 and 54,000 cones per hectare respectively). In addition, there is a trend to higher residual cone densities with increasing age of the harvested stand.

Final results will be included in a report due October, 1990.

## Project #65 Seed Preconditioning

A co-operative trial was initiated with Canadian Pacific Forest Products, Thunder Bay, to determine the effectiveness of stratification on the establishment of direct-seeded black spruce and jack pine. Seed stratified in moist cold (+2° C) conditions for 0, 7, 15 and 30-day periods was sown in May, June, July and August 1989 either as bare seed or under cerkon shelter cones. Preliminary results indicate that stratified seed germinated faster than control seed for both species. However, stratification did not increase the number of germinants per spots, stocking, or first-year height of either species. A summary of first-year results is being prepared. This trial will be continued in 1990/91.

**Seeding stratified seed into shelter cones.**

## Project #66 Stand Dynamics of Clumped Jack Pine

Clumping of jack pine results from many artificial regeneration techniques commonly used in northwestern Ontario, such as hand seeding, cluster seeding with a Bracke scarifier, or shelter seeding. Compared to jack pine planted at controlled even spacings, dynamics of clumped jack pine are not well understood at either the tree or stand level. Information on clump distribution, density and dynamics is needed to streamline pre-commercial thinning priorities and growth and yield forecasts.

A study was undertaken in the summer of 1989 by KBM Ltd., to determine the number of jack pine clumps across a range of regeneration techniques (including natural fire), and stand ages. In addition, selected characteristics of clumped trees were compared to adjacent free-growing trees.

Preliminary results show no significant difference in the absolute number of clumps per hectare with regeneration method, although aerially seeded areas tended to have fewer clumps. However, there was a significant difference in the proportion of stems growing in clumps compared to total number of stems per hectare with regeneration method, ranging from 15% in stands originating from wildfire to 51% with shelter cone seeded stands.

These and other results with be detailed in a Technical Report due November 1990.

## Project #67 Development of a Technique for Interpreting FEC Information from Aerial Photography

The objective of this project is to develop a technique and methodology for reliably typifying NWO FEC vegetation and soil conditions using aerial photography, and land resource inventory information supplemented by ground- truthing. Project management has been held by R.G. White, Regional Silviculturalist, Northwestern Region.

Outputs will consist of a consultant's report (GeoMatics International) which will include the following subject areas:

* tools and inventory data required to complete the work;
* a step-by-step procedure for completing the interpretation;
* manpower/time required to complete the work;
* procedures for data management; and
* a summary of difficulties encountered when interpreting particular FEC conditions.

In addition, a two-day training course was held in Kenora in January 1990 for District staff persons which involved them in aspects of the Alneau Peninsula demonstration project.

A final report is expected in June 1990.

**Project #68 Bracke Seeding Trial**

In the fall of 1983, a trial was conducted north of Thunder Bay (Canadian Pacific Forest Products Limited's Camp 603) to test various Bracke seeding rates and scalp arrangement in relation to: i) operational efficiency; ii) germination success; and iii) resultant density and stocking of clumped versus free-growing trees over time.

Measurements were taken one and two years later, and final data was collected in the fall of 1988. A final report will be written by September, 1990 (Roy Sidders, Red Lake District) updating his interim report based on the second year's data. Initial results indicated that recommended seeding rates varied with mattock arrangement, from a high of 20 seeds per scalp with scalps 2 x 2 m apart, to a low of five seeds per scalp when only 1 x 2 m apart.

**Project #70 Chemical Site Preparation**

A project was established in cooperation with Abitibi Price and Dupont Canada, to determine the effectiveness of four herbicides (Velpar-L, Velpar-ULW, Pronone and Vision) as chemical site preparation, and to evaluate the response of black spruce and jack pine planted and seeded crops to the treatments. To date, the plots have been established, a preliminary vegetation survey completed, the treatments applied and an establishment report compiled. In 1990 and 1991, black spruce and jack pine will be established on the plots by planting and seeding. Both survival and growth will be assessed after the first, second and fifth growing seasons following establishment. Changes in competitive species will be documented using the competition index developed at the NWOFTDU.

**Application of Pronone 10G for the chemical site preparation trial (June 1989).**

**Project #71 Modified Cutting and Hunting Restrictions for Moose**

Age-Sex surveys were flown on the Sagagnos-Mowe study area in the southwest corner of Thunder Bay District. Overall, moose densities were .87/km$^2$. Densities were higher in the prohibited hunting areas than in the areas which were open to hunting.

The remainder of the study area will be opened to hunting in the fall of 1990. Data on harvest rates, final moose age-sex estimates and harvest patterns will be collected. Population response to hunting will be monitored over three years to determine if closures were an effective strategy when combined with application of the moose habitat guidlines.

**Project #72 A Guide For the Application of Mechanical Site Preparation Equipment in Northwestern Ontario**

With the increased variety and sophistication of equipment used in silvicultural practice, the forest manager often has the problem of deciding upon the most suitable tool to meet management objectives. This, together with species and site/soil complexities of the boreal forest region, challenges the manager's ability to correctly select an appropriate treatment. The recently available Northwestern Ontario Forest Ecosystem Classification system can be used as a framework for organizing information related to appropriate site preparation objectives and constraints.

The objectives of this cooperative (Forestry Canada) three-year project is to develop a field guide for the application of mechanical/chemical site preparation to northwestern Ontario sites, with an emphasis on understanding species/micro-site requirements and the biological and operational constraints to tree establishment and survival.

During 1989/90, the majority of time was devoted by Forestry Canada staff to the collection and review of published literature dealing with mechanical site preparation relevant to northwestern Ontario. To date, more than 600 articles have been processed from Canada, the United States, Fennoscandia and Europe.

Published information was supplemented by a survey of experience-based opinion which involved all client groups. Highlights from the meetings were as follows:

i) The guide must have a simple format utilizing keys from which biologically-sound micro-site prescriptions can be related to the mechanical site preparation treatments and to the FEC treatment unit concept; and

ii) Information on prime movers should be restricted to site limitations or trafficability considerations.

A steering committee consisting of forest industry and OMNR representatives was convened in 1989/90 by the NWOFTDU and will continue to serve as a 'sounding board' for Forestry Canada staff assigned to the project.

During 1990/91 a draft table of contents, interpretive keys and charts will be complete and verified through field inspection and consultations involving client and NWOFTDU staff. A publication target date of 1991/92 remains in place.

## Project #73 The Control of Residual Poplar Re-growth on Former Jack Pine Dominated Sites in the Brightsands FMA Forest

Trembling aspen growing within jack pine stands in northwestern Ontario is often localized owing to the fire ecology of the respective species. Following a disturbance by harvesting, however, trembling aspen reproduction via suckering and seeding is favoured. This change is further encouraged by mechanical site preparation, which creates suitable microsites, not only for the germination and growth of jack pine, but also for aspen suckering and seeding. It is not uncommon for the aspen component to increase from 0.2 to 0.6 of normal stocking in the regenerated stand.

Controlling the amount of aspen allowed to regenerate on former jack pine dominated sites in the Brightsands Forest is critical since the regeneration stategy favours maintaining the relative balance already established between hardwood and softwood species. The objectives of this project are as follows:

a) To evaluate post-harvest manual herbicide application methods for controlling aspen re-growth on sites scheduled to be seeded to jack pine;
b) To evaluate the efficacy and selectivity of the various treatment methods in controlling aspen residuals and aspen re-growth; and
c) To evaluate the economics of the various herbicide treatment alternatives and the influence of scale on their utilization.

The study area is located near Canadian Pacific Forest Products Camp 603, on five blocks possessing similar soil, site and pre-harvest stand conditions. Each of these areas had been full-tree harvested during the winter of 1987/88 and mechanically site prepared in 1989. Treatments consisted of the following: Spotgun application of Velpar-L to the base of residual aspen in each of June and August respectively; stump treatments with a 10% solution of Vision in each of June and July respectively; 'Slash and Squirt' application of Vision to standing residual aspen in July; aerial application of Vision at 1.78 kg ai/ha in July; and EZ-Ject application of Vision to standing residuals.

Observations on pre-treatment hardwood and shrub reproduction, densities of natural conifer regeneration and forest floor composition were made prior to treatment application in 1989.

The trial will be monitored and data collected on an annual basis until 1993/94. An establishment report was completed for the project in 1989/90 and the baseline data was verified and input into computer files for future analysis. Work for 1990/91 consists of remeasuring all plots and entering the first-year post-treatment data into the project data base. This project is a cooperative effort involving Monsanto Forestry Products Canada, Canadian Pacific Forest Products and the NWOFTDU.

## Project #74 White Pine Management in Northwestern Ontario

With recent concerns about logging in old growth pine stands in northwestern Ontario, requests to increase the proportion of white pine in Quetico Park, and local shortfalls in white pine supply to sawmills, there was a need to re-evaluate white pine management in northwestern Ontario.

An initiative was undertaken in 1989 to update and collate all the most recent information available about white pine management with relevance to northwestern Ontario conditions. Of particular interest were blister rust hazard ratings and zonation, growth and yield information by site type, the distribution of prime white pine site types across northwestern Ontario, methods of natural regeneration, age class distributions by management area, and seed availability from local or other sources.

A report is due in August, 1990 and should provide the technical basis on which an active white pine management strategy for northwestern Ontario can be built.

**Project #75 Gaspardo (Bartt) Seeder**

Tests in 1988 showed that the Gaspardo (Bartt) seeder attachment for disc trencher type scarifiers was capable of singulating seed to prescribed levels. Some modifications were required to overcome certain practical problems which arose from the 1988 tests.

With these modifications in place, a trial was conducted in Dryden district in the summer of 1989 to determine: i) the operational efficiency of a fully functional unit; and ii) comparative seed germination rates, and stocking and densities between treated areas vs. natural ingrowth on control areas.

First-year data were collected in the fall of 1989. A final report will be prepared by March 31, 1991, incorporating second-year data collected by Dryden district staff in the fall of 1990.

**Project #76 Fine Soils Productivity in the Pakwash and Patricia Forests**

In co-operation with Boise Cascade, Kenora, a study was undertaken in the fall of 1989 to investigate the timber growing capacity of the Pakwash and Patricia forests. Soils in this area are typically clayey, and little is known of their inherent site productivity, especially for jack pine and black spruce.

Eight stands were sampled and a total of 19 jack pine and 11 black spruce were stem-analyzed by the TRIM (Tree Ring Increment Measuring) system. Vegetation types were determined using the Forest Ecosystem Classification for Northwestern Ontario. Bulk C horizon samples were collected from each site and were hand textured.

Preliminary results indicate that jack pine grows faster than black spruce in terms of both height and volume on these site types. Additional sampling is required in 1990 to complete site descriptions for all plots, and to augment stem analysis with additional data.

A final report with results and possible comparisons to recently published variable density yield tables for managed stands in northwestern Ontario will be available by March 31, 1991.

**Project #77 Economic Analysis for Crop Planning**

The economic analysis for the crop planning project has three components:

i) Development of a software package to facilitate management regime design and selection on a single hectare basis;
ii) Appropriate alterations to FORMAN/NORMAN (including some further economic calculations and graphics); and
iii) A crop planning case study (Port Arthur Crown Management Unit).

The work is being undertaken through a contract with Jeremy Williams. The software package and the adjustments to FORMAN/NORMAN are ongoing with completion scheduled for June 1990.

### Project #78 Black Spruce Regeneration Options

The objective of this project was to determine the most effective black spruce regeneration method on heavy soil sites in the Red Lake and Kenora districts by comparing survival, initial growth and establishment costs of natural regeneration, shelter seeding, hand seeding and planting container stock. Six replications of the four regeneration treatments were established in each of the districts in May 1989. In the fall of 1989, germination, stocking and growth were assessed for the seeded treatments and survival and growth were measured for the container stock. Data have not yet been analyzed. The trial will be monitored in the fall of 1990 and again at year five.

### Project #79 Stock Handling Guidelines for Northwestern Ontario

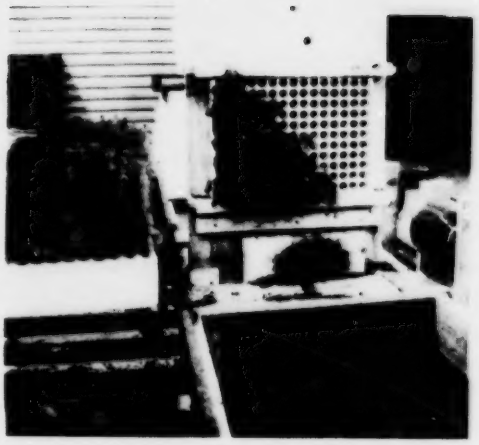
**Stock handling Guidelines include snow cache construction.**

Field guidelines for planting stock handling were last written in 1983 for the North Central Region and do not exist for Northwestern Region. The purpose of this project was to gather together documented information and 'expert opinion' into a user-friendly guide for field personnel to both improve and standardize the approach to stock handling across northwestern Ontario. Under the guidance of a steering committee, guidelines were developed covering all practices associated with bareroot and container stock handling from the nursery to the planting hole. A draft of the guide lines will be circulated for use during the 1990 planting season, with the final version being published in September, 1990.

### Project #80 Operational Cold Storage of Container Stock

Cold storage is an attractive alternative to overwintering container stock, as it can reduce the damage associated with current outdoor overwintering practices. The purpose of this project was: i) to determine if overwinter cold storage of extended greenhouse black spruce raised in styroblocks and paper pots is operationally feasible; ii) to compare the survival and growth of cold-stored stock with that of conventional outdoor storage; and iii) to fine-tune the methodology for cold storage, grading, handling and shipping of black spruce container stock.

In 1989, the first lot of seedlings was grown, extracted (styroblocks) and overwinter stored, and was outplanted in May of 1990 on three site types: sand, sandy loam and silty clay. The trial will continue for three years with each year's planting being assessed after the first and second growing season. As part of the project 333,000 container stock will be placed in cold storage each year for the three years.



**Container stock extraction for operational cold storage.**

## Project #81 Glyphosate, Wildlife and Lesser Vegetation

Three reports resulting from the analysis of additional data from the glyphosate trial in the Thunder Bay District have now reached their completion. The reports include: "Small mammal and lesser vegetation response to glyphosate tending in North Central Ontario"; "Winter utilization by moose of glyphosate treated cutovers"; and a third report dealing with the effects of glyphosate treatment on crop tree response. Editing is required on the reports before distribution in 1990.

## Project #82 Ontario Moose Habitat Interpretation Manual

A moose habitat interpretation manual was taken to the first draft stage in 1989/90. This was a joint project involving the NWOFTDU and the coordinator of Timber Management Guidelines. The manual uses a written description of the habitat values for moose, accompanied by pictures and maps. This manual is designed to facilitate featured species management by ensuring that all those involved in Timber Management Planning have a clear understanding of what to look for, how to interpret it and where to find supporting information.

A steering committee was established to direct the initial development of the interpretation manual. In 1990 the manuscript will be sent out for review. The publication should be available in September, 1990.

## PROJECTS ADMINISTERED BY NWOFTDU WITH OTHER FUNDING SOURCES

Several other projects were administered by NWOFTDU during 1989/90 using other funding sources. These included completion of the Northwestern Ontario Forest Ecosystem Classification; a crop planning process for northern Ontario forests; aerial application of Velpar-L on a sandy-loam soil for conifer release; and the preparation of a brochure on the Thunder Bay Spacing Trial.

### Northwestern Ontario Forest Ecosystem Classification (NWO FEC)

The NWO FEC has been described previously under projects 40, 56 and 69. The completion and publication of the three manuals were partially funded from COFRDA during 1989/90.

### A Crop Planning Process for Northern Ontario Forests

The link between forest-level planning and stand-level implementation in Ontario has been weak. User-friendly forest resource simulators such as FORMAN provide an opportunity to improve forest-level planning by substantially increasing the forester's analytical capability by quickly adapting forest-level management changes to realities at the stand level.

Crop planning as outlined in this report can be an important step in building a solid linkage between forest management and timber supply in Ontario. The process provides the volume forecasts that are missing from the standard area-regulation approach, and the process provides an analytical tool to design silviculture regimes that have the right kind of power in the unique context of each forest. Used as an analytical tool, crop planning will maximize the learning of each manager about the forest being managed. The result should be forest management that is designed to more efficiently achieve specific goals in a specific forest.

### Aerial Application of Velpar-L on a Sandy Loam Soil for Conifer Release

A liquid formulation of hexazinone (Velpar-L) was aerially-applied on coarse loamy soil as a chemical site preparation for conifer species near Raith, Ontario in 1987. The objectives of this study were: i) to monitor short and long-term response of crop trees and target species as well as shifts in vegetation composition; and ii) to investigate correlations between treatment efficacy and soil types.

This randomized factorial split plot design featured four application rates, three stock types and two planning dates replicated three times.

The 5,960 crop trees planted in 1987 and 1988 respectively, were reassessed during the summer of 1989, noting survival and condition codes.

The cooperating agencies on this project continued to be Abitibi-Price Inc., and OMNR Forest Health and Protection Section. Funding for the 1989 field work was provided by the latter agency with on-site coordination and data entry provided through the NWOFTDU. The target date for the publication of an interim progress report is fall 1990.

**Forest Research and Management Demonstration Area: Thunder Bay Spacing Trial**

The brochures and self-guiding, interpretative trail were described in the 1988/89 NWOFTDU Annual Report. Invoices for the project were not received in time to be processed in 1988/89 and were paid in 1989/90 from COFRDA funds.

## ADMINISTRATION

### Staffing

During 1989/90, there were a number of staff changes at the NWOFTDU. These included Al Willcocks, Manager of NWOFTDU becoming Acting District Manager, Thunder Bay District; Bill Baker replaced Al Willcocks and is the Acting Manager, NWOFTDU; Lisa Buse, Specialist-in-Training has filled the Black Spruce Program Forester Position; and Colin Bowling has replaced Pat Corbett as the Pine Program Forester in Kenora. The NWOFTDU staff at the end of 1989/90 consisted of:

Permanent (Classified) Staff

Bill Baker, Manager (Acting)
Bill Towill, Mixedwood Program Forester
Colin Bowling, Pine Program Forester (Kenora)
Gerry Racey, Integrated Resource Management Specialist
Nancy Knudsen, Administrative Officer

Contract Staff (Recurring, Unclassified)

Lisa Buse, Black Spruce Program Forester (Acting)
Glen Niznowski, Pine Project Forester (Kenora)
Wayne Bell, Special Projects Forester
Laura Scott, Systems Officer (shares position with Thunder Bay Forest Nursery)

Technical Staff

Tim Cavanagh, Resource Technician
Bill Van Schip, Resource Technician
Mark Roddick, Resource Technician

Clerical Staff

Karen Caruk, Administration Clerk
Alanna Warren-Daze, Clerical Assistant

Staff at the Thunder Bay office can be contacted at (807) 939-2501, FAX: (807) 939-1918. The Kenora based staff can be reached at (807) 468-2650 or 468-2500, FAX: (807) 468-2737.

**Office/Equipment**

Some improvements were made to the NWOFTDU building in Thunder Bay. These included upgrading of the telephone system, overhauling the trailer complex for additional office and equipment space and the purchase of additional computer work stations and software.

Vehicles represent a major expenditure for the NWOFTDU's operation. Vehicles for 1990/91 were partially pre-paid ($50 M) at year end of 1989/90.

## PROGRAM EVALUATION/REVIEW

A provincial evaluation/review of the NWOFTDU was undertaken between February 5 to 8, 1990. The review panel consisted of six members:

John Walker (Chairman), Ontario Forest Research Institute, OMNR
John Gordon, Dean, Forestry and Environmental Studies, Yale University
George Westarp, MacMillan Bloedel, Nanaimo, British Columbia
Vic Sleep, Forester (Retired), Spruce Falls Pulp
Jim Baker, Wildlife Branch, OMNR
Vic Wearn, Forest Resources Group, OMNR

Overall, the review of NWOFTDU's activities and products was favourable. The review team (and our clients) gave a very good report card as they had no conceptual difficulties with the NWOFTDU's program and felt there was a good infrastructure for delivery.

Notwithstanding these strengths, there were a number of areas for improvement. A general summary of those are:

1) The structure and process of the NWOFTDU committee system should be reviewed with respect to efficiency and effectiveness, particularly since the NWOFTDU has "matured" with time;

2) The project/problem identification mechanism should be enhanced by NWOFTDU staff holding problem/opportunity identification sessions in the field, with all clients. This will also enhance the Integrated Resource Management (IRM) nature of projects where appropriate;

3) A system for vetting all forestry and IRM 'projects' undertaken in the two regions should be established by directive. This system should mesh with the formal NWOFTDU process and should include input from Regional Silviculturalists and Wildlife specialists;

4) Provincial projects should only be undertaken by the NWOFTDU with the knowledge and concurrence of the steering/executive committee;

5) Continued attention should be given to the retention and motivation of NWOFTDU staff;

6) Direct involvement in the undertaking of large symposia should cease;

7) Encouragement/promotion of the 'buy-in' of non-forests staff to the NWOFTDU process should continue;

8) More formal linkages with Regional Silviculture and Wildlife specialists should be developed;

9) Reduction of the amount of energy devoted by NWOFTDU staff to the actual undertaking of projects should occur. This energy could then be re-channelled to the extension/field workshop/information management areas; and

10) Some effort should be spent on defining the longer term niche of the NWOFTDU.

A more detailed account of the NWOFTDU program evaluation will be found in the summer 1990 issue of the newsletter.

## BUDGET

The NWOFTDU had a budget allocation of approximately $1.2 million from OMNR and MNDM funding sources during 1989/90. (In addition, $79.5 M was allocated for the completion of three COFRDA projects.)

Expenditures from these funds for NWOFTDU activities amounted to $1.124 million. Table 1 summarizes the expenditures by major program or activity. Tables 2 through 5 provide details of expenditures for the core program, technology management, technology transfer and the development/demonstration projects funded by OMNR and MNDM. Expenditures on projects funded by agencies other than OMNR and MNDM are found in Table 6.

**Table 1. Summary of 1989/90 NWOFTDU Expenditures ($M) (OMNR and MNDM Funding)**

| | A[1] | B[2] | TCSSE[3] | TOTAL |
|---|---|---|---|---|
| Core (Base) Program | 254.3 | 55.6 | 192.2 | 502.1 |
| Technology Management/ Transfer | | 129.9 | 84.6 | 214.5 |
| Development Projects: | | | | |
| Ongoing Projects | | 6.5 | 138.6 | 145.1 |
| 1989/90 New Projects | | 186.5 | 75.7 | 262.2 |
| **TOTAL** | 254.3 | 378.5 | 491.1 | 1,123.9 |
| (Allotment[4]) | (267.0) | (397.0) | (510.0) | (1,174.0) |

1. Permanent (regular) staff
2. Contract (casual) staff
3. Transportation, communications, services, supplies and equipment
4. Allotment as identified in 1989/90 NWOFTDU Work Plan.

**Table 2. 1989/90 Core (Base) Program Expenditures ($M) (OMNR and MNDM Funding)**

| | A | B | TCSSE | TOTAL |
|---|---|---|---|---|
| 1. Salaries | 254.3 | 33.7 | | 288.0 |
| 2. Telephone, Hydro, Heat | | | 19.3 | 19.3 |
| 3. Staff Training, Workshops | | 6.5 | 11.1 | 17.6 |
| 4. Building Maintenance/ Renovations | | 11.6 | 17.9 | 29.5 |
| 5. Office Supplies/Copying | | | 39.8 | 39.8 |
| 6. Computer/Systems | | 3.8 | 9.2 | 13.0 |
| 7. Committee Expenses | | | 4.1 | 4.1 |
| 8. Travel/Vehicles | | | 90.8 | 90.8 |
| **TOTAL** | 254.3 | 55.6 | 192.2 | 502.1 |

**Table 3. 1989/90 Technology Management and Transfer Program Expenditures ($ M) (OMNR and MNDM Funding)**

| | B | TCSSE | TOTAL |
|---|---|---|---|
| **A) TECHNOLOGY MANAGEMENT** | | | |
| Literature Review | 17.3 | 14.2 | 31.5 |
| Library | 30.8 | 2.3 | 33.1 |
| Old Trial Inventory | 51.2 | 2.2 | 53.4 |
| SUB-TOTAL | 99.3 | 18.7 | 118.0 |
| (Allotment) | (108.0) | (20.0) | (128.0) |
| **B) TECHNOLOGY TRANSFER** | | | |
| Extension Services | 11.4 | 18.1 | 29.5 |
| Newsletter | 0.0 | 2.9 | 2.9 |
| Workshops | 19.2 | 44.9 | 64.1 |
| SUB-TOTAL | 30.6 | 65.9 | 96.5 |
| (Allotment) | (41.0) | (44.0) | (85.0) |
| **TOTAL** | 129.9 | 84.6 | 214.5 |
| (Allotment) | (149.0) | (64.0) | (213.0) |

**Table 4. Ongoing NWOFTDU Development Projects Expenditures ($M) (OMNR and MNDM Funding)**

| PROJECT NO. | PROJECT | B | TCSSE | TOTAL |
|---|---|---|---|---|
| 40 | FEC Guide | 0.0 | 8.2 | 8.2 |
| 41 | Post-Spray Assessment | 0.0 | 5.9 | 5.9 |
| 42 | Wildlife Forestry Video | 0.6 | 13.4 | 14.0 |
| 46 | Shelter Seeding | 2.0 | 1.4 | 3.4 |
| 47 | Overwinter of Container Stock | 1.3 | 0.0 | 1.3 |
| 48 | Container Stock Storage Options | 0.0 | 6.0 | 6.0 |
| 49 | Pj Seeding on Silts and Clays | 2.3 | 0.8 | 3.1 |
| 53 | Verification Sb Site Index | 0.3 | 0.0 | 0.3 |
| 56 | FEC Classification | 0.0 | 102.9 | 102.9 |
| | **TOTAL** | 6.5 | 138.6 | 145.1 |
| | (Allotment) | (12.0) | (76.0) | (88.0) |

**Table 5. 1989/90 New NWOFTDU Development Projects ($M) (OMNR and MNDM Funding)**

| PROJECT NUMBER | PROJECT | B | TCSSE | TOTAL |
|---|---|---|---|---|
| 62 | Black Spruce Aerial Seeding | 2.7 | 0.6 | 3.3 |
| 63 | Site Quality Evaluation Handbook | 27.5 | 8.0 | 35.5 |
| 64 | Seed Source After Full Tree Loggin | 7.2 | 1.7 | 8.9 |
| 65 | Seed Preconditioning | 10.8 | 1.5 | 12.3 |
| 66 | Stand Dynamics in Clumped Pj | 0.0 | 13.2 | 13.2 |
| 67 | Precut Survey Method/Photo Interps. | 1.1 | 12.4 | 13.5 |
| 68 | Bracke Seeding Trial | 0.1 | 0.0 | 0.1 |
| 69 | Further Dev. of FEC Interp. | 14.6 | 1.9 | 16.5 |
| 70 | Chemical SIP Trials | 5.4 | 1.5 | 6.9 |
| 71 | Mod. Cut/Moose Hunt Restrictions | 2.0 | 13.0 | 15.0 |
| 72 | Guide Applic. - Mech. Site Prep | 20.3 | 1.5 | 21.8 |
| 73 | Control Residual Poplar Regen. | 16.2 | 5.6 | 21.8 |
| 74 | White Pine Management in NW Ont. | 4.7 | 0.1 | 4.8 |
| 75 | Gaspardo Seeder | 0.0 | 2.0 | 2.0 |
| 76 | Heavy Soils Productivity | 9.2 | 0.3 | 9.5 |
| 77 | Economic Analysis | 1.8 | 4.2 | 6.0 |
| 78 | Sb Regeneration Options | 6.3 | 3.0 | 9.3 |
| 79 | Stock Handling Guidelines | 5.9 | 0.0 | 5.9 |
| 80 | Cold Storage of Container Stock | 2.1 | 1.4 | 3.5 |
| 81 | Glyphosate | 29.8 | 2.2 | 32.0 |
| 82 | Moose Habitat Primer | 18.8 | 1.6 | 20.4 |
| | **TOTAL** | 186.5 | 75.7 | 262.2 |
| | (Allotment) | (171.0) | (163.0) | (334.0) |

**Table 6. Other Projects Administered by NWOFTDU, 1989/90 ($M)**

| PROJECT | B | TCSSE | TOTAL | FUNDING SOURCE |
|---|---|---|---|---|
| A) Northwestern Ontario FEC | 9.8 | 21.5 | 31.3 | COFRDA |
| B) A Crop Planning Process for Northern Ontario | 6.0 | 20.2 | 26.2 | COFRDA |
| C) Aerial Application of Liquid Hexazinone | 0.0 | 0.0 | 0.0 | Forest Health & Protection OMNR |
| D) Thunder Bay Spacing Trial | 0.0 | 7.8 | 7.8 | COFRDA |
| **TOTAL** | 15.8 | 49.5 | 65.3 | |
| (Allotment) | (14.0) | (65.5) | (79.5) | |

**Table 7. Funding Sources Administered by NWOFTDU ($M)**

| | A | B | TCSSE | TOTAL |
|---|---|---|---|---|
| Ministry of Northern Development and Mines (MNDM) | 254.3 | 294.0 | 29.4 | 577.7 |
| MNR: | | | | |
| Operating Budget | | 53.4 | 424.3 | 477.7 |
| Forest Management Agreements (non-direct) | | 12.5 | | 12.5 |
| Softwood Lumber Tax | | 18.5 | 36.0 | 54.5 |
| COFRDA | | 15.8 | 49.5 | 65.3 |
| **TOTAL** | 254.3 | 394.2 | 539.2 | 1,187.7 |

## 1989/90 NWOFTDU PUBLICATIONS

1. Prescribed burning for black spruce regeneration in northwestern Ontario (TR-14).

2. Growth and yield of northwestern Ontario boreal forest species: An annotated bibliography (TR-31).

3. Spruce height and volume growth response to an aerial release treatment using 2,4-D on three plantations near Manitouwadge, Ontario (TR-8).

4. Can jack pine site productivity in north central Ontario be predicted using multiple regression soil-site equations? (TR-33).

5. Can we use the northern prime land classification to identify the productivity of jack pine sites in north central Ontario? (TR-34).

6. Why have riparian reserves in timber management? A literature review (TR-45).

7. Aspects of site preparation: Biology and practice (WR-02).

8. Design and analysis of experiments : A short course for forestry practitioners.

9. A comparison of crop tree and competing vegetation response to brushsaw release with Vision versus spot treatment of Velpar-L (TR-07).

10. A crop planning process for northern Ontario forests (TR-30).

11. Snow cache seedling storage (TN-03).

12. Marten and Fisher response to cutovers (TN-04).

13. An examination of cutting patterns proposed in the guidelines for the protection of tourism values (TN-05).

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Copies available from:
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